

**Minutes of the Ad Hoc Science Working Group**  
**Meeting # 4**  
**30-31 July, 1998**  
**Belmont Conference Center**

*Attendees:* We attach a copy of the attendance sheets for the first day of the meeting. Of the NASA and ESA ASWG members -- including the recently selected ISIM leads -- only Don Hall and Mike Fall were unable to attend the meeting. Of those ASWG members who attended on Thursday, only Avi Loeb and John Trauger were unable to return on the second day because of previous commitments.

*Agenda:* A copy of the final meeting agenda is also attached. In general, the meeting followed the order and substance of the agenda, with most of the meeting devoted to discussions of the submitted DRM Programs. Here we include actions and votes taken for the record.

*Welcome and Discussion of the Agenda* (Stockman and Mather)

*NGST Project Status:* Bernie Seery discussed the status of the Project in terms of issues and goals for 1998. This presentation is available on the NGST Web site. In general, the NGST Project has addressed the issues and goals for '98 and is poised for the second meeting of the Standing Review Board on 6-8 October and a presentation to GSFC management prior to going into a "Phase A" -type period. Indeed, Bernie believes that we have accomplished most of the normal Phase Activities and will put more emphasis on technology development and some detailed design. 2 Aerospace contractors will be selected for the next phase of studies with the RFP being posted in the Dec.-Jan. timeframe.

*HQ View of the Project:* Harley Thronson provided an overview of NGST as seen from HQ as well as recent scoop about Huntress's replacement -- unknown as yet. Harley discussed the rationale behind the Science Preliminary Non Advocate Review and the need to prepare for the Decade Committee review. Harley also noted that a number of relevant NRAs are on the street or about to hit it. Tune into the HQ web site.

*ISIM Summaries:* Matt Greenhouse described the extensive Phase-A type study that is underway at GSFC. The six other ISIM leads provided introductions of their teams and overviews of their goals for the next year. There was some concern about the marked difference in level of study already done on the NASA Yardstick mission and that we could expect from the individual ISIM studies. The Yardstick study is being done with the goal of being a smart customer and determining the detailed feasibility of the ISIM as well as likely generic technical issues. The point contact for the ISIM leads at GSFC is

Richard Burg. Burg will set up a meeting with the ISIM leads at GSFC in September or October. One of the most important goals of that meeting will be to discuss the cost estimates for the ISIM and instrument modules developed by the Project study.

*DRM Discussions:* The ASWG discussed the > 20 DRM Programs submitted and/or described in the meeting. With the exception of the UMBRA proposal by Schultz et al, all programs were deemed to be suitable for the NGST DRM, but we were unable to prioritize the programs individually in terms of time. The UMBRA proposal was not included because it required another spacecraft to be launched and fly in formation to occult the central stars (or AGN) so that faint planets could be detected. The scientific goal was felt to be good -- and should be worked up as a goal for coronagraphy -- but the 2nd spacecraft posed issues of cost and credibility for a mission already faced with such issues. The following are notes from John Mather and me regarding the results of the DRM presentations. Homework assignments are attached and will be distributed by email to the ASWG.

As a result of these discussions, we have validated the Dressler scientific goals as translated into the Core and Stretch capabilities for NGST, with the selected ISIM study teams representing all the stretch goals as well as the core. We have some revisions to do in preparing a real reference book out of this work. The accepted DRM concepts will be included in the DRM for use in measuring the performance of proposed concepts. They have been grouped into 5 themes for presentation to the world, and all are important and exciting, with the potential for front-page New York Times discoveries. The themes were decided by extensive discussion and mutual agreement. They are approximately

- 1) Cosmology and the Structure of the Universe (SNe Type 1s at  $z=1-2$ , Dark Matter Studies, Reionization of the Universe). {DRMs:3,4,6,SNe}
- 2) The Origin and Evolution of Galaxies (Earliest star clusters, early galaxies, dynamics, QSO and GRB hosts, QSO as beacons to probe intervening galaxies.) {DRMs 1,9,11,14,15,16,17,18, AGN}
- 3) The History of the Milky Way and its Neighbors (stellar populations and ages of stars in the Milky Way and its neighbors out to the Virgo Cluster, Machos) { DRMs 2, 21,22 from Rich}
- 4) The Birth and Formation of Stars (The study of protostars and ISM in nearby star formation regions -- out to the LMC) { DRMs 12,13,19,ISM}
- 5) The Orgins and Evolution of Planetary Systems (Debris disks -- dust and gas - around stars in nearby star forming regions, detecting planets/non-stellar companions around nearby stars, studies of the Kuiper Belt and other possible fossil evidence of the early

stages of star formation in our own solar system.) { DRMs 7,8,10,20, Trauger coronagraphy/direct imaging of exoplanets proposal }

At the end of this process, the ASWG estimated the approximate priorities of the five themes in terms of % of the 2.5 year "core mission." These priorities had a remarkably tight dispersion:

1) 21.3%; 2) 32.8%; 3) 14.6%; 4) 16.5%; 5) 14.6%

It is now the responsibilities of the "theme leads" to work with those whose DRMs fall into these themes to breakout the times per DRM. This will require the DRMs to be reworked to eliminate overlapping scientific goals and also to make use of the same survey materials. It was found that the three major imaging surveys proposed by Peter Schneider for the dark matter "maps"/studies would probably be exactly what the galaxy theme requires, including the SNe discovery and followup spectroscopy.

*Preparations for the Science PNAR and Decade Review:* Harley reviewed again the goals of the science PNAR and the agenda which is approximately that shown below:

#### Day 1

Project Status/Schedule  
Science Overview  
Five Key Science Themes  
Tour of the DRM  
The ISIM Concepts

#### Day 2

Telescope Designs & Procurement Plans  
Technology Program  
NGST Budget  
Science Outreach Plan  
Feedback from the PNAR Panel

To prepare for the PNAR we reviewed the needed capabilities and agreed that the following were "necessary" (these are from Mather's notes and agree with my more limited notes and memory!):

"1. 1-5 micron cameras and multiobject spectroscopy (exact type not

settled, but Range 3000 needed)

2. 8 m aperture
3. 0.5 micron extension of camera, diffraction limited imaging at 1.5 microns, with multiple filters but without spectroscopy. This is needed for galaxy formation and for star studies.
4. 27 micron extension of imaging and spectroscopy
5. 30 micron imaging with narrow band H2 28 micron (tunable?) line filter. The H2 line is very important.
6. Rapid time response, target of opportunity within ~1 week, for supernovae, GRBs, etc.
7. Ability to observe particular regions of the (cosmologically interesting) sky for at least 6 months without long interruptions, because of supernova monitoring"

"We considered, but did not label as "necessary", the following capabilities:

1. Coronagraphic searches for planets. The science was considered excellent, but the feasibility has not yet been discussed in depth. We await the results from John Trauger's study.
2. Moving object tracking for planets, satellites, comets, asteroids, and outer solar system objects. We have not yet heard much from the scientific communities involved in these studies about the potential benefits to science, and we don't know anything about the cost with current NGST concepts.
3. 40 micron imaging. It's desirable but has not been discussed enough to say it should be allowed to drive the telescope design. So far the emphasis has been on the fact that even if the telescope is too warm to reach the zodi limited sensitivity, it will still be better than SIRTf in sensitivity and 10 x better in angular resolution, and well worth while, even with modest detectors (today's technology)."

"(We did not discuss whether there is any requirement on roll angle range, the ability to always have the sky fall on the detector with the same orientation. We are currently assuming that this can be handled by software and multiple observations (drizzling technique). This needs to be checked.)"

"We also agreed on the following emphasis in selecting design concepts:

1. Wide field is emphasized because many of our programs require it; our targets are many and not close together.
2. Parallel observations by different instruments are very important, because deep imaging and spectroscopy can both proceed together saving time."

In terms of cost containment, the group discussed Mather's "descope" concept, and understands and agrees that this is a COST driven project. As Mather says "It is better to get the NGST up promptly and learn the science and technology that it can produce, and go on to bigger and better missions later, rather than trying to make NGST perfect now."

With that, the meeting adjourned. A list of action items will be sent separately -- for proper and prompt consideration.